

PROGRAM CHARTER
FOR
GEODESY

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1. EXECUTIVE SUMMARY

NOAA's Geodesy program has grown out of a 200-year old requirement to provide the nation with geodetic and geographic positioning services. This set of capabilities was developed initially to serve cartographers and surveyors of the nation's coasts and waters. The advent of GPS technology revolutionized the surveying industry and introduced a new avenue for improving the National Spatial Reference System (NSRS). NOAA's Geodesy program now provides a common reference system for establishing the coordinate positions of all geographic data.

The mission of the NOAA Geodesy Program is:

- A. To define, maintain and provide access to the National Spatial Reference System to meet our nation's economic, social, and environmental needs, and
- B. 2) To be a world leader in geospatial activities, including the development and promotion of standards, specifications, and guidelines.

The NSRS is the national coordinate system that specifies latitude, longitude, height, scale, gravity, and orientation throughout the nation. NSRS includes the following components:

- o An infrastructure of geodetic control networks,
- o Sets of models and tools to make the infrastructure useable and accessible, and
- o Education and outreach to teach people how to effectively use the infrastructure.

The Geodesy Program is housed entirely within NOAA's National Geodetic Survey (NGS). NGS is the nation's preeminent civilian positioning agency, and is in the forefront of state-of-the-art creative applications of positioning science. NGS provides airport surveys to the Federal Aviation Administration (FAA), critical for landing airplanes safely. This service has been provided to FAA on a continuous basis for many years.

The Geodesy Program is part of the NOAA Commerce and Transportation Goal in the Program, Planning, Budgeting, and Execution System (PPBES). Geodesy Program headquarters are located within the NGS offices in Silver Spring, Maryland. NGS also maintains offices in Norfolk and Corbin, Virginia, and has employees in Boulder, Colorado.

Geodesy activities occur in all 50 states and many U.S. territories. Thirty-three states and Puerto Rico have their own Geodetic Advisors or Coordinators.

Additional program information is available at the National Geodetic Survey website:

<http://www.ngs.noaa.gov>

2. PROGRAM REQUIREMENTS

A. Requirements Drivers

- 1) Coast and Geodetic Survey Act, Public Law 80-373, 33 U.S.C. 883a et seq., 1947. Defines the functions and duties of the Coast and Geodetic Survey (predecessor to NOAA's National Ocean Service). This act authorized the Department of Commerce to conduct geodetic control surveys; field surveys for [Federal Aviation Administration (FAA)] aeronautical charts; developmental work for the improvement of surveying and

cartographic methods, instruments, and equipment; and investigations and research in geophysical sciences, including geodesy and seismology.

- a) The Hydrographic Services Improvement Act of 1998, Public Law 107-372 reauthorized December 19, 2002, 33 U.S.C. 892 et seq. Directs NOAA to manage, maintain, interpret, certify, and disseminate geodetic information.
- b) Establishment of Nationwide Differential Global Positioning System (NDGPS), Public Law. 105-66, title III, Sec. 346, 1997, 111 Stat.1449. Ensures that the U.S. Dept. of Transportation NDGPS reference stations are compatible with, and integrated into, the GPS Continuously Operating Reference Station (CORS) system of the National Geodetic Survey; and investigates the use of the NDGPS reference stations for the GPS Integrated Precipitable Water Vapor System of NOAA.
- c) Office of Management and Budget (OMB) Circular No. A-16 Revised, August 19, 2002 Coordination of Geographic Information and Related Spatial Data Activities. Provides direction for federal agencies that produce, maintain or use spatial data either directly or indirectly in the fulfillment of their mission. The Circular establishes the Federal Geographic Data Committee, and assigns NOAA as the Federal Geodetic Control theme lead (and subcommittee chair), and identifies the (NOAA managed) National Spatial Reference System as the fundamental geodetic control for the United States.
- d) National Height Modernization Study, Report to Congress, June 1998. Provides guidance and justification for nationwide implementation of the height modernization project.
- e) U.S. Space-Based Positioning, Navigation, and Timing Policy Fact Sheet, December 15, 2004. Establishes national policy for the management and use of the U.S. Global Positioning System and related U.S. Government augmentations. National Space-Based Positioning, Navigation, and Timing Executive Committee (PNTEC) is responsible for the management of GPS and U.S. Government augmentations to GPS. PNTEC represents the highest level of GPS policy determination involving the civil agencies. As Chair of the GPS Interagency Advisory Council (GIAC), the director of NGS is a member of the PNTEC Steering Group.
- f) 2001 Federal Radionavigation Plan, U.S. Departments of Transportation and Defense, December, 2001. US commitment to the Global Positioning System (GPS) and its modernization as a primary means of navigation in support of the U.S. transportation infrastructure.
- g) Aviation System Standards (AVN) Agreement. Agreement with FAA that directs NGS to deliver Area Navigation Approaches and related products and services in support of aeronautical charting.
- h) Air Traffic Information Services (ATA-100) Agreement. Directs NGS to produce airport obstruction charts for FAA.
- i) Memorandum of Agreement between the Navy and NGS - 2003. As part of a continuing interagency agreement, NOAA, through NGS, provides the National Earth Orientation Service with polar motion series based on GPS orbit analysis, and with GPS support for Very Long Baseline Interferometry (VLBI) observations at the Fortaleza, Brazil Radio Astronomy Observatory.
- j) International Global Navigation Satellite Systems Service (IGS) Terms of Reference. As one of 7 analysis centers of the IGS, NOAA computes GPS Satellite orbits for inclusion in the International Earth Rotation and Reference Systems Service (IERS). The IERS serves the astronomical, geodetic and geophysical communities by providing:

- The International Terrestrial Reference System (ITRS) and its realization, the International Terrestrial Reference Frame (ITRF).
 - Geophysical data to interpret time/space variations in the ITRF or earth orientation parameters, and model such variations.
 - Standards, constants and models (i.e., conventions) encouraging international adherence.
- k) Informal Agreement with the Instituto Nacional de Estadística Geografía e Informática (INEGI). Since 1991, NOAA has been cooperating with the INEGI, Aguascalientes, Mexico, through informal agreements to share Mexican and American CORS data.

B. Mission Requirements:

The Requirements Drivers mandate the following responsibilities which the Geodesy program fulfills. Each Requirement is linked back to the supporting Requirements Drivers (driver number in parentheses).

- 1) Manage, maintain, interpret, certify, and disseminate geodetic information.
 - a) Linked Drivers: Coast and Geodetic Survey Act (1); The Hydrographic Services Improvement Act of 1998, as amended (2); OMB Circular No. A-16 Revised, August 19, 2002 (4); National Height Modernization Study, Report to Congress, June 1998 (5).
- 2) Act as the federal geodetic control theme lead and define, maintain and provide access to the National Spatial Reference System as the fundamental geodetic control for the United States.
 - a) Linked Drivers: Office of Management and Budget (OMB) Circular No. A-16 Revised, August 19, 2002 (4); National Height Modernization Study, Report to Congress, June 1998 (5).
- 3) Develop Federal geodetic standards, specifications, and guidelines, participate in development of international geodetic policy, standards, and guidelines and participate in the development of GPS and other global navigation satellite system policy to the extent it relates to the NSRS.
 - a) Linked Drivers: The Hydrographic Services Improvement Act of 1998, as amended (2); National Height Modernization Study, Report to Congress, June 1998 (5); U.S. PNT Policy Fact Sheet, December 15, 2004 (6); IGS Terms of Reference (11).
- 4) Provide positioning instrument testing and calibration services to ensure accurate implementation of NSRS.
 - a) Linked Drivers: Coast and Geodetic Survey Act (1); Hydrographic Services Improvement Act of 1998, as amended (2).
- 5) Develop and make publicly accessible models and tools relating spatial datums and describing geophysical, atmospheric, equipment, and GPS orbit phenomena impacting accurate spatial measurement.
 - a) Linked Drivers: Coast and Geodetic Survey Act (1); Hydrographic Services Improvement Act of 1998, as amended (2); IGS Terms of Reference (11).
- 6) Enhance GPS augmentation by managing, monitoring, and providing access to the CORS Networks, in support of civil positioning and the U.S. transportation infrastructure.
 - a) Linked Drivers: The Hydrographic Services Improvement Act of 1998, as amended (2); Establishment of NDGPS, Public Law. 105-66 (3); 2001 Federal

Radionavigation Plan (7); Agreements with INEGI (12).

7) Conduct geodetic control surveys.

- a) Linked Drivers: Coast and Geodetic Survey Act (1); The Hydrographic Services Improvement Act of 1998, as amended (2).

Obligations Under Interagency Agreements:

8) Deliver Area Navigation Approaches and related products and services in support of aeronautical charting.

- a) Linked Drivers: Aviation System Standards (AVN) Agreement (8).

9) Field surveys for Federal Aviation Administration (FAA) aeronautical charts.

- a) Linked Drivers: Aviation System Standards (AVN) Agreement (8); Air Traffic Information Services (ATA-100) Agreement (9).

10) Produce airport obstruction charts for FAA.

- a) Linked Drivers: Air Traffic Information Services (ATA-100) Agreement (9).

11) Calculate polar motion series based on GPS orbit analysis.

- a) Linked Drivers: MOA between the Navy and NGS – 2003 (10).

12) Provide GPS support for Very Long Baseline Interferometry (VLBI) observations at the Fortaleza, Brazil Radio Astronomy Observatory.

- a) Linked Drivers: MOA between the Navy and NGS – 2003 (10).

13) Host Continuously Operating Reference Station (CORS) data and operate the Online Positioning Users Service (OPUS) in foreign countries.

- a) Linked Drivers: Coast and Geodetic Survey Act (1); Hydrographic Services Improvement Act of 1998, as amended (2)

3. LINKS TO THE NOAA STRATEGIC PLAN

A. Goal Outcomes Supported

The Geodesy Program supports both of the NOAA Commerce and Transportation Goal's Outcomes to ensure the safe, secure, efficient and seamless movement of goods and people in the U.S. transportation system, and to promote the environmentally sound development and use of the U.S. transportation system. The Geodesy Program supports these outcomes by managing the NSRS, the basis for mapping, charting, navigation, boundary determination, property delineation, construction, and other applications. This common geographic framework is part of the fundamental infrastructure for all the nation's commerce.

In addition, the Geodesy Program provides secondary support to the outcomes of NOAA's Ecosystem, Climate, and Weather and Water Mission Goals. The Geodesy Program supports the Ecosystem Goal by developing technology to enable high-precision, four-dimensional mapping of the shallow sea floor (including seagrasses and coral reefs) and land contours. High accuracy land elevations are combined with water level data to support coastal and wetland restoration. The Geodesy Program supports the Climate Goal by providing technology to distinguish geophysical and oceanic phenomena and thereby accurately gauge sea level rise along the coast. The Geodesy Program also supports the Weather and Water Goal by providing GPS observations the Forecast Systems Lab (FSL) uses to measure atmospheric precipitable water vapor for short-term weather forecasting. These GPS observations also contribute to monitoring space weather conditions. Finally, accurate coordinates, especially height information, derived from the Geodesy program play a critical role in creating storm surge and coastal vulnerability modeling. In sum, any NOAA activity that requires an accurate latitude, longitude, elevation, gravity, scale, or orientation

measurement is supported by the Geodesy Program.

B. Goal Performance Objectives

The Geodesy Program supports the Commerce and Transportation Goal Performance Objectives to realize national economic, safety, and environmental benefits of improved, accurate positioning capabilities, and enhance navigational safety and efficiency by improving information products and services.

C. Goal Strategies

The Geodesy Program supports the Commerce and Transportation Goal Strategies to 1) expand and enhance advanced technology monitoring and observing systems, such as weather and oceanographic observations, ice forecasts and nowcasts, hydrographic surveys, and precise positioning coordinates, to provide accurate, up-to-date information, 2) develop and apply new technologies, methods, and models to increase the capabilities, efficiencies, and accuracy of transportation-related products and services, 3) develop and implement sophisticated assessment and prediction techniques, products, and services to support decisions on aviation, marine, and surface navigation efficiencies; coastal resource management; and transportation system management, operations, and planning, and 4) build public understanding of the science and technology involved and the role of the environment in commerce and transportation through outreach, education, and industry collaboration.

4. PROGRAM OUTCOMES

- A. Ensure anything within the United States and its territories geographic objects can be consistently and accurately located.
- B. Support the integration of accurate geospatial data into the full range of societal needs.

5. PROGRAM ROLES AND RESPONSIBILITIES

This program is established and managed with the procedures established in the NOAA Business Operations Manual (BOM). Responsibilities of the Program Manager are described in the BOM. Responsibilities of other major participants are summarized below:

A. Participating Line Office, Staff Office and Council Responsibilities:

- 1) NOAA Ocean Service, the sole NOAA Line Office for the Geodesy Program, is responsible for:
 - a) applying state-of-the-art methods of precise positioning and advanced geodetic, photogrammetric, and remote sensing techniques to establish and maintain a consistent national coordinate system and to support mapping, charting, navigation, boundary determination, property delineation, infrastructure development, resource evaluation surveys, and scientific applications;
 - b) meeting users' spatial control requirements through a hierarchy of monumented points and a network of Global Positioning System (GPS) Continuously Operating Reference Stations (CORS).
 - c) defining, maintaining and providing access to the National Spatial Reference System (NSRS);
 - d) calculating GPS (and in the near future Global Navigation Satellite System (GNSS)) satellite orbits, and providing the orbit calculations to outside federal agencies and the public;
 - e) supporting research to increase the effectiveness and broaden the application of geodetic, photogrammetric, and remote sensing technologies;
 - f) conducting research in geosciences, including earth orientation, gravity, satellite geodesy, and related fields;

- g) providing geodetic control for and mapping of selected airports, and provides additional specialized products to the Federal Aviation Administration (FAA) and airline industry;
 - h) receiving and validating appropriate geodetic control data from other Federal agencies, as well as from state and local government and the private sector, and serving as a national repository for accepted geodetic data;
 - i) providing technology transfer services to other Federal, state, and local government personnel, the private sector, and other nations through the state advisor program, spatial reference centers, cooperative survey programs, special training activities, and other technical assistance;
 - j) facilitating the development of networked, integrated, local geodetic data bases in support of the National Spatial Data Infrastructure (NSDI).
- 2) NOAA General Counsel is responsible for providing legal assistance to NGS, including approving grants and interagency agreements.
 - 3) Administrative Services is responsible for providing administrative support for grants.
 - 4) Facilities is responsible for providing a safe and productive work environment.
 - 5) Information Technology Services is responsible for providing the general IT services required by the program.
 - 6) The Acquisition and Grants Office is responsible for providing policy guidance and program support in acquisition and financial assistance. award and administration.

B. External Agency/Organization Responsibilities

- 1) U.S. Federal Aviation Administration (FAA) is responsible for informing NGS of FAA survey and charting requirements, and providing corresponding resources (funding) to NGS. The FAA supports NGS' CORS network through its Wide-Area Augmentation System (WAAS), which consists of ground based GPS reference stations.
- 2) U.S. Department of Defense is responsible for maintaining the GPS satellite constellation. GPS data is now an integral part of the National Spatial Reference System.
- 3) U.S. Department of Transportation is responsible for maintaining and operating the National Differential GPS reference stations, and ensuring they are compatible with and integrated into the National CORS Network.
- 4) State Spatial Reference Centers, which are partnered with NOAA through NGS, are responsible for informing NGS of state and local needs, implementing the National Spatial Reference System at a state level, and building state capacity to use and interact with the National Spatial Reference System (including training state and local users).
- 5) CORS Network Partners: Geodesy has partnered with over 680 institutions to be a part of the National CORS Network, and with 140 institutions to be a part of the Cooperative CORS Network. Partners include a wide range of academic, federal, state, municipal, and private entities. All partners are responsible for maintaining their respective CORS stations. National CORS Network Partners are also responsible for providing NGS with the station data for inclusion in the NGS database. Cooperative CORS partners are responsible for maintaining their own station data, and for providing NGS access to that data.

6. END USERS OR BENEFICIARIES OF PROGRAM

The Geodesy program meets a wide variety of users' spatial control requirements through a

hierarchy of monumented points and a network of GPS CORS. The health of a nation's economy is directly dependent upon its ability to accurately locate property and infrastructure. Geodesy provides the common geographic framework that is essential to commerce.

Investment in the Geodesy Program assures a national foundation for spatial reference, the development of positioning tools and technology, and their transfer to end users. These elements are essential for the safe, secure, efficient and environmentally sound movement of goods and people in the U.S. transportation system. Specific end users include:

- A. General Public - The Geodesy program supports technological innovation and increased access to accurate geographic data, allowing a wide segment of the population to benefit from the many spin-offs of GPS technology, including a wide range of recreational activities such as hiking, biking, boating, fishing, hunting and sports.
- B. Private sector:
 - 1) Surveyors- The program provides the surveying community with the infrastructure, models and tools, and capacity building products and services to allow accurate positioning to the centimeter level.
 - 2) Civil engineers- The program provides accurate geodetic data to engineers involved in construction projects requiring precise positioning.
 - 3) Geographic Information Systems industry- Geodetic control provides the fundamental infrastructure layer for GIS software and applications.
 - 4) Aviation industry- The program provides geodetic control for and mapping of selected airports, as well as other products and services to the FAA and airline industry.
 - 5) Maritime industry- The program provides accurate geodetic data used to improve navigation and the accuracy of GPS positioning for shipping.
 - 6) Positioning equipment manufacturers- The program provides the data and positioning infrastructure used by positioning equipment manufacturers in developing high-end positioning products.
 - 7) Academia - The Geodesy program supports research to increase the effectiveness and broaden the application of geodetic, photogrammetric, and remote sensing technologies.
 - 8) International Partners - The Geodesy program supports international astronomical, geodetic and geophysical communities, in matters relating to geodetic control, research and standards. Specific international organizations include: the International Earth Rotation Service, International GPS Service, and International Boundary Commission.
 - 9) State and Local Governments - The Geodesy program provides grants to states and services such as the State Advisor program, which are designed to fill the need for more accurate local geodetic surveys and are in response to the state and local governments' desire to improve their surveying techniques to meet Federal standards and specifications.
 - 10) Emergency Managers - The Geodesy program provides accurate, timely heights and positioning information to support emergency managers in storm evacuation route planning, flood plane management and homeland security projects.
 - 11) Other Federal Agencies - The Geodesy program supports and is the geodetic control theme lead for federal agencies that produce, maintain or use spatial data either directly or indirectly in the fulfillment of their mission. These agencies include:
 - 12) US Department of Commerce
 - a) Other NOAA

- Office of Coast Survey (OCS)
 - Center for Operational Oceanographic Products and Services (CO-OPS)
 - Great Lakes Environmental Research Laboratory (GLERL)
 - Office of Response and Restoration (ORR)
 - Office of Ocean and Coastal Resource Management (OCRM)
 - Forecast Systems Laboratory (FSL)
 - b) National Institute of Standards and Technology (NIST)
- 13) US Department of Defense
- a) National Geospatial Intelligence Agency (NGA)
 - b) US Army Corps of Engineers (USACE)
 - c) US Air Force
- 14) US Department of Homeland Security
- a) US Coast Guard (USCG)
 - b) Federal Emergency Management Agency (FEMA)
- 15) US Department of Interior
- a) US Geological Survey (USGS)
 - b) Bureau of Land Management (BLM)
- 16) US Department of Transportation
- a) Federal Aviation Administration (FAA)
- 17) National Archives
- 18) Environmental Protection Agency (EPA)
- 19) National Aeronautics and Space Administration (NASA)
- C. Coastal and other resource managers - The Geodesy program allows accurate elevation information to be used for wetland restoration and other coastal and resource management projects.
- D. Students and their teachers- The Geodesy program provides teaching aids and other educational information about the science of Geodesy, tailored specifically for teachers and their students.